Appendix A
Regional Weather Features

Mexico

Mexico south of the Tropic of Cancer and east of the Sierra Madre Oriental is continuously exposed to the Atlantic easterlies, which bring orographic precipitation and occasionally tropical disturbances. Interior Mexico normally receives 90 percent of its rainfall between June and October. During the winter, this subregion is reached by cool winds and storms from the north that may continue to the Isthmus of Tehuantepec on both coasts. In late summer, southern Mexico is occasionally invaded by intertropical fronts from the south that bring moist air and frontal waves.

Central America

The entire Central American isthmus is exposed to the easterlies throughout the year and to occasional northerlies in winter. The Caribbean Coast is subject to a large amount of orographic precipitation accompanied by thunderstorms. At Bluefields, Nicaragua, the mean annual precipitation exceeds 400 cm. The Pacific Coast, in the shadow of the Cordillera, receives far less rainfall. At Managua, for example, which is geographically opposite Bluefields, the mean annual precipitation is only 115 cm. This contrast is greatest from January to March, locally termed the "verano" (dry season). During this period, Bluefields normally receives 50 cm of precipitation, whereas Managua receives only about 1 cm. However, during the "invierno" (wet season), from April to December, the intertropical convergence zone enters these areas and brings disturbances that produce copious precipitation over both coasts. Managua receives 98 percent of its rain from May through November.

The Isthmus of Panama is subject to easterlies almost constantly from December to April, a period during which only about 11 percent of the annual rainfall occurs. The intertropical front normally crosses the isthmus from south to north in May and produces rainy weather until a short dry period in July. This is followed by the return of the intertropical front and unsettled weather from the southwest from August to November. Despite this general pattern, there is a marked contrast in rainfall between Colon on the Atlantic Coast, which has a mean annual precipitation of 340 cm, and Balboa on the Pacific, which receives 170 cm (Portig 1976).

West Indies

Weather in the West Indies is dominated by airflow from the Atlantic. At Bridgetown, Barbados, for example, the variation in mean monthly wind direction is only 21°; the annual mean is 90° (due east) (Portig 1976). From Hispaniola and Jamaica to Trinidad, the heaviest precipitation is from May to November, interrupted by a dry period in July. There is a marked difference in precipitation on windward and leeward exposures because of orographic lifting. At Guanica, on the leeward coast of Puerto Rico, for example, precipitation is only 52 percent of the precipitation received at Fajardo on the windward coast, only 130 km distant. From May to October, intense rain squalls may develop in this subregion under enormous cumulonimbus clouds.

Cyclonic storms (with winds of 62 km/hr or more) and hurricanes (with winds of 117 km/hr or more) are characteristic of the West Indies (Alaka 1976). These storms originate in the Atlantic between latitudes 10° and 30° N., often as far east as the Cape Verde Islands. Most frequently, they enter the Caribbean Sea in the latitude of the Lesser Antilles. Generally, these storms pass westward to the south of Cuba and enter the Gulf of Mexico, dissipating their energy over northeastern Mexico or southeastern United States; or they pass northwestward to the north of Cuba, thereupon leaving the Tropics and veering to the northeast. Based on observations from 1901 to 1972, the probability of at least one hurricane occurring each year ranges from 0.22 in June to a high of 0.88 in September and a low of 0.17 in November. Wind gusts of 250 km/hr or more and total rainfall of 240 cm over 4 days have been recorded.

The southern Windward Islands, Trinidad, and the adjacent Venezuelan coast are subject to northeasterly winds from January to May without frontal weather. At Bridgetown, Barbados, for example, only 20 percent of the annual rainfall is received during these months (Portig 1976). Between June and December, moist equatorial air masses produce continual tropical fronts with thunderstorms from north of Trinidad to the estuary of the Orinoco River. Farther west, along the Caribbean coasts of Venezuela and the Netherlands Antilles, easterlies prevail, resulting in a dry region. At San Pedro de Coche, Venezuela, for example, only about 300 km west of Trinidad, the mean annual precipitation is only 27 cm (Walter and others 1975).

South America

The Caribbean coast of Colombia is predominantly under the influence of the intertropical front. From January to April, northwest winds produce little precipitation. Cartagena normally receives only 2 percent of its annual rainfall during these 4 months. In May, the arrival of the front from the south brings southwest winds and heavy

cumulonimbus clouds and thunderstorms that subside in July. A second period of intense storms occurs in November. The extreme northeastern Guajira Peninsula escapes this influence, receiving a mean annual precipitation of only about 30 cm (Snow 1976).

The Pacific slope of the Colombian and Ecuadorian Andes south to the Gulf of Guayaquil is permanently under the influence of moist and unstable equatorial maritime air. Andagoya, Colombia, for example, receives at least 50 cm of precipitation every month. Just south of the Gulf of Guayaquil, a heavy stratus cloud layer hangs almost continuously over the entire coast southward beyond the Tropic of Capricorn. The weakness of onshore winds and the tendency of the clouds to dissipate over the heated land prevent the coast from receiving any precipitation. At Molienda, Peru, for example, the wettest month of the year averages less than 1 cm of precipitation. Between June and September, a thin drizzle may fall along the immediate coastline, but inland areas remain cloudless and arid.

In the Orinoco-Guiana subregion, there is a sharp contrast in precipitation from east to west. Cayenne, French Guiana, receives precipitation averaging 370 cm annually, whereas San Fernando de Apure in the Venezuelan Llanos receives 150 cm (Snow 1976). This contrast is particularly pronounced during December, when the Guianas receive great quantities of precipitation from equatorial maritime air, as well as January (75 cm versus 1 cm). During the northern solstice, the intertropical front lies over this region and brings heavy showers, particularly between May and August when the Venezuelan Llanos receive about 70 percent of their annual precipitation (Snow 1976).

Extreme eastern Brazil experiences stable air during the spring, while a drying effect is felt throughout the lower and middle Amazon Basin. Recife, for example, normally receives less than 10 percent of its annual rainfall from September through December. During the southern solstice, this subregion may experience heavy showers with the convergence of the intertropical front. However, in years when the front does not advance far enough to the southeast, disastrous droughts are inflicted on the region of Fortaleza and Bahia.

The climate of the Amazon Basin is affected throughout the year by the convergence of the easterly air mass as it approaches the Eastern Cordillera of the Andes. Mean annual precipitation decreases upriver from Belem (270 cm) to Santarem and Manaus (200 cm), and then rises to 280 cm at Fonte Boa and Iquitos in Peru. Large convective clouds and heavy showers of increasing intensity approaching the Cordillera are characteristic. The mountain crest itself is almost permanently cloud covered. Cloudiness is the reason the mean temperature at Iquitos (24.8 °C) is lower than at Manaus (27.2 °C).

The interior highlands that extend from Brazil south to Paraguay, eastern Bolivia, and northern Argentina are virtually without precipitation during the northern solstice. Cuiaba, Brazil, for example, normally receives less than 20 percent of its annual precipitation between April and September. La Quiaca, Argentina, receives less than 5 percent during this time. During these months, the valleys of the Paraguay and Parana Rivers and the Gran Chaco are relatively cold. The mean July temperature at Corumba, Brazil, at latitude 19° S. and at an altitude of only 138 m, is 21 °C; an extreme low temperature in July was 4 °C (Ratisbona 1976).

Some representative climatic means from throughout the latitudinal range of the American Tropics appear in table A–1.

Table A–1.—Representative climatic means in tropical America

Latitude	Altitude (m)	Mean annual precipitation (cm)	Mean temperature (°C)	Climatic station
23° N.	20	120	25	Havana, Cuba
22° N.	20	120	24	Tampico, Mexico
21° N.	130	140	25	Camaguey, Cuba
20° N.	2,000	180	15	Terquitlan, Mexico
19° N.	50	160	25	Veracruz, Mexico
18° N.	0	190	26	Belize City, Belize
17° N.	2,130	120	14	San Cristobal de las Casas, Mexico
16° N.	0	260	26	Tela, Honduras
15° N.	140	180	25	Fort-de-France, Martinique
14° N.	820	440	25	San Andreas, Osuna, Guatemala
13° N.	60	130	26	Bridgetown, Barbados
12° N.	10	420	26	Bluefields, Nicaragua
11° N.	40	160	25	Port of Spain, Trinidad and Tobago
10° N.	1,120	190	20	San Jose, Costa Rica
9° N.	1,500	180	19	Merida, Venezuela
8° N.	0	430	26	Jaque, Panama
7° N.	0	240	27	Georgetown, Guyana
6° N.	100	220	27	Puerto Ayacucho, Venezuela
5° N.	60	690	27	Andagoya, Colombia
4° N.	420	410	26	Villaviciencio, Colombia
3° N.	100	160	28	St. Ignatius, Guyana
2° N.	110	350	26	San Carlos de Rio Negro, Venezuela
1° N.	10	270	27	San Lorenzo, Ecuador
0°	80	290	25	Uaupes, Brazil
1° S.	950	430	26	Belem, Brazil
2° S.	950	430	26	Puyo, Ecuador
3° S.	50	200	27	Manaus, Brazil
4° S.	100	280	26	Iquitos, Peru
5° S.	80	110	26	Barraldo Gorda, Brazil
6° S.	20	270	26	Manicore, Brazil
7° S.	140	270	25	Alto Tapajos, Brazil
8° S.	60	150	26	Recife, Brazil
9° S.	660	310	25	Tingo Maria, Peru
10° S.	240	180	26	Porto Nacional, Brazil
12° S.	3,380	70	19	Huancayo, Peru
13° S.	260	190	25	Puerto Maldonado, Peru
14° S.	1,380	130	20	Apolo, Bolivia
15° S.	910	160	21	Formosa, Brazil
16° S.	520	180	24	Goias, Brazil
17° S.	20	130	24	Pirapora, Brazil
18° S.	440	100	24	Santa Cruz, Brazil
19° S.	140	110	25	Corumba, Brazil
20° S.	920	160	21	Belo Horizonte, Brazil
21° S.	560	140	22	Riberao Preto, Brazil
22° S.	160	130	23	Bela Vista, Brazil

Source: Walter and others 1975, Wernstedt 1961